faunas of temperate zones with seasonal climate were slightly to moderately affected by the PTB biotic crisis.

- There was a delayed extinction event at the top of the *Hindeodus postparvus-H. sosioensis* Zone in cold-water adapted faunas which survived the PTB without extinction, flourished and diversified in the lowermost Triassic after the extinction of the warm-water fauna in the Tethyan realm.
- The recovery time for the warm-water benthos and siliceous plankton was unusually delayed (about 5 Ma) because this recovery occurred only in the upper Olenekian to Middle Triassic interval.
- The recovery of the nekton and nektobenthos was mostly rapid, after the lowermost Triassic *H. parvus* conodont zone that had a short duration < 0.1my).
- The productivity of the terrestrial plants dropped strongly and the recovery occurred mainly in the upper Olenekian and in the Middle Triassic.
- Several extinction events occurred in the terrestrial faunas within the Upper Permian, considerably below the marine PTB, and for different fossil groups at different stratigraphic levels. At the marine PTB, only a very slight extinction event can be observed in vertebrates, when "remnant" Permian forms (*Dicynodon*) disappeared. At, or close to, the often used continental PTB (FAD of *Lystrosaurus*) no extinction event of any terrestrial faunal element can be observed. Such terrestrial faunal elements mainly survived the PTB biotic crisis, which were able to survive some months of extreme climatic conditions (e.g. severe drought, cold or even freezing conditions in low latitudes) by hibernation-type live stages (vertebrates) or by drought- and freeze-resistant eggs (conchostracans, some fresh-water ostracods). Good examples are the vertebrate *Lystrosaurus* which is known both from low latitude and from high latitude areas with polar night, the conchostracan *Falsisca* and the ostracod *Darwinula* which occurred both in low latitudes and in high latitudes within the Permo-Triassic polar circle.
- Distinct terrestrial floral changes (of global character) occurred during the upper Dorashamian, when in most parts of the world the trilete cavate spores of lycopodiales became dominant, whereas several species of gymnosperm pollen disappeared. Until the end of the Permian a low diversity terrestrial flora was established and the terrestrial plant production became low. During the lower and middle Scythian the terrestrial plant production remained low.
- About 50 % of the genera that disappeared at the PTB reappeared in the Olenekian-Middle Triassic interval (Lazarus taxa). In some groups the percentage of Lazarus genera is 90-100 % (e.g., holothurians, scolecodonts).
- Only very few major fossil groups totally disappeared at the PTB. Most of these groups had a very low diversity and/or a regional restriction at the end of the Permian to Tethys or even to eastern Tethys (trilobites, rugose corals, fusulinids).
- The PTB is preceded by mass occurrences of marine (and continental) fungi and the fungal spike ended abruptly a little before the PTB, in eastern Tethys at a volcanic dust fall-out a little below the biochronologic PTB.

The lost in biomass production was so large that changes in sedimentary patterns occurred, e.g., lower and middle Scythian radiolarite gap, Scythian coal gap, boundary clay in otherwise continuous carbonatic sequences, absence of Scythian reef limestones, drastic drop in the frequency of bioclastic limestones, widespread occurrence of stromatolites even in water depth below the storm-wave base, widespread lower-middle Scythian sandstones (rapid transport of weathering products because of absence of dense vegetation also under rather wet climate). The lost in biomass production caused also a remarkable drop in $\delta^{13}C$.

The observed extinction and recovery patterns can be best explained by a volcanic winter, followed with some delay by a strong global warming (Kozur 1994, 1998a, b, Conaghan et al. 1994). This event couple triggered and preserved for long a time the latest Dorashamian to middle Scythian superanoxia (world-wide oceanic black shales, dysaerobic conditions even above the storm-wave base in many areas, wide-spread laminated shales and limestones in the lower Scythian). The huge amount of dust and SO_2 aerosols were transported so high that the ozone layer was depleted (end of the Dorashamian fungi spike !), but according to Detre et al. (1998) this was caused by a supernova explosion cosmically close to the sun system. However, the microsphaerules (tiny sphaerules of molten material) that are world-wide very common in the uppermost Dorashamian may be also of volcanic origin. The volcanic winter in connection with huge explosive felsic to intermediate volcanic activity at the margin Panthalassa/eastern Tethys in low northern latitude had especially effected the low latitude tropical and subtropical seas, where the warm-water fauna died out. It survived, however, on the shelves of intra-oceanic islands in Panthalassa, but most of the warm-water benthos could re-settle the Tethyan shelves only after the end of the superanoxia in the upper Olenekian and in the Middle Triassic.

Further geological phenomena, such as the severe Dzhulfian-Dorashamian climate in many parts of the world caused by the continent-ocean configuration and by long-lasting Siberian Trap volcanism, the extinction event at the Guadalupian-Lopingian boundary that restricted most of the affected warm water faunas to the Tethys, and the lower-middle Scythian anoxia have also taken into consideration for explanation of the PTB biotic crisis.

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Fluvio-aeolian interaction in the Koigab Fan area - Skeleton Coast, Namibia

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In this study we use a combination of Landsat TM5 image analysis, field surveying and sediment petrography to illustrate the various expressions of modern fluvio-aeolian interaction in the Koigab Fan area of the Namibian Skeleton Coast.

The Skeleton Coast is part of the northwestern Namibian Atlantic coastline, between the Ugab River in the south and the Kunene River in the north. This area is hyperarid with less than 50 mm average annual rainfall and a rainfall variability of 72 %. Predominant influences on climate are the cool northward-flowing Benguela Current offshore Namibia and its associated cold-water upwelling system, the subtropical South Atlantic anticyclone and the monsoonal influences controlled by the Indian Ocean.

The Skeleton Coast is characterized by the 2000 km² Skeleton Coast dunefield, also termed the Northern Namib Sand Sea (NNSS). Transverse and barchanoid dunes constitute a roughly S-

N trending dune belt 165 km long and 3-15 km wide, which runs parallel to the Atlantic coastline at a distance of 2-5 km inland. The dunefield starts abruptly with a series of barchans and large compound barchan dunes about 15 km north of the Koigab River. With a length of 130 km and a catchment area of about 2400 km^2, this river is one of the smallest ephemeral rivers of the Skeleton Coast. The modern Koigab River is incised into a terminal coastal fan, the Koigab Fan, covering about 345 km^2 and extending over about 20 km from the coastal escarpment towards the Atlantic coastline. This shallowly sloping braided fluvial fan consists mainly of semi- to unconsolidated sand and gravel with a thickness of <30 m. In addition, many barchans and shrub coppice dunes can be found all over the fan surface aligned to the dominant strong S and SSW onshore winds. This implies that the modern fan surface is modified by both fluvial and aeolian processes, in which several features of fluvio-aeolian interaction can be observed:

(a) volcaniclastic detritus, the majority of which is derived from quartz-latitic rheoignimbrites and basaltic lavas of the Cretaceous Etendeka volcanic Plateau, is deposited by sheet floods and channelized flows in numerous shallow braided channels spread over the entire Koigab Fan surface. As the river flows not every year, and then only for some days, long-lasting, inter-flood intervals exist. Then, aeolian processes dominate, with aeolian winnowing of fluvially deposited sand and gravel as soon as the sediment surface dries out;

(b) strong southerly winds erode and rework most of the fluvially generated sandy bar forms. Only gravelly bar forms and sand protected by thick mud drapes, the latter deposited during waning flood stages, have a potential to become preserved. The winnowed sand is then mixed with other aeolian transported material of various derivation to be either trapped by scrubby vegetation on the fan surface or added to the Skeleton Coast dunefield;

(c) subsequent flooding events of the Koigab River erode and rework, particularly in intra-channel areas, sand ramps and small coppice dunes, causing a mixing of recycled fluvio-aeolian detritus with juvenile fluvial sediment.

Grain size distribution parameters and heavy mineral analyses show that the Koigab Fan has considerable influence on the composition of aeolian sediments. For instance, sand samples taken from small coppice dunes south of the ephemeral river show much lower magnetite contents when compared to river sediments or aeolian deposits north of the main Koigab River course. We suggest that the magnetite is derived from basalts and quartz-latites of the Etendeka Group, which dominate the catchment area of the Koigab. Another traceable source of aeolian sand is the Torra Bay granite, outcropping within and north of the Koigab River mouth area. This coarse-grained hornblende-biotite granite is rich in garnet (almandine) and these garnets can be detected in sand samples from the southern part of the NNSS.

Moderne Hexactinelliden-Riffe von Britisch Kolumbien/Kanada

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Hexactinellide Kieselschwämme sind in den tieferen Meeresbereichen recht häufig und aus allen Ozeanen weltweit bekannt. Schwammriffe, die von diesen Organismen aufgebaut werden und die in der Erdgeschichte durchaus öfters vorkommen, treten heutzutage nur noch auf dem Tiefschelf vor der Küste von Britisch Kolumbien (Kanada) auf und sind hier in einer Wassertiefe von etwa 180 m und 250 m vorhanden. Auf dem schwach geneigten und durch extreme Mangelsedimentation charakterisierten kontinentalen Schelf, bilden hexactinose Schwämme Mudmounds von teilweise recht großen Ausmaßen. Die größten Mudmounds werden bis 18 m hoch und zeigen teilweise steile Flanken, deren Fallwinkel bis 90° betragen kann. Neben Biohermen sind auch Kieselschwamm-Biostrome entwickelt. Diese können sich, bei einer Mächtigkeit von 2 m bis 10 m, über mehrere Quadratkilometer erstrecken.

Initiale Riffbildung erfolgt meist zuerst entlang von Eisbergfurchen, die während der letzten Eiszeit (Wisconsinan) vor etwa 13000 Jahren entstanden sind. Solange sie noch klein sind, bleiben die Riffe zunächst noch isoliert und wachsen dann mit zunehmender Größe zu größeren Komplexen zusammen.

Die Kartierung des Schelfs mit Hilfe akustischer Methoden (Sidescan Seismic System, Huntec Deeptow High Resolution Seismic System) zeigt, daß die Schwammriffe heute eine Fläche von etwa 1000 km^2 bedecken.

Tauchfahrten mit einem bemannten U-Boot ergaben, daß die Schwammriffe aus einer niederdiversen Hexactinosa-Gemeinschaft bestehen. Untergeordnet sind auch Vetreter der Lyssakinosa vorhanden. Die großwüchsigen Schwämme bilden außerordentlich dichtstehende Populationen, die die Riffe mehr oder weniger flächendeckend bedecken. Drei hexactinose Schwammarten (*Aphrocallistes vastus*, *Farrea occa*, *Chonelasma calyx*) bilden ein Riffgerüst, indem sie gegenseitig aufeinander aufwachsen und ihre rigiden Schwammskelette fest durch Abscheidung von Skelettopal (Opal A) miteinander verbinden. In das zuerst offene Riffgerüst wird durch die baffelnde Wirkung der dicht stehenden Schwammindividuen vor allem Ton und untergeordnet Silt eingelagert. Das siliziklastische Sediment stabilisiert das Riff. Es ist sehr reich an Organik und im wesentlichen dys- bis anoxisch. Außerhalb der Schwammriffe ist kein Sediment akkumuliert. Die pleistozäne Sedimentoberfläche ist hier noch völlig nackt. Geröll und Blockschutt bilden hier daher den Meeresboden.

Ein Endobenthos ist abgesehen von wenigen polychaeten Würmern (*Terebella* sp.), nicht entwickelt. Das schwach entwickelte Epibenthos (excl. Schwämme) setzt sich aus terebratuliden Brachiopoden und Echinodermen (Echinoidea, Ophiuroidea) zusammen. Diese treten insgesamt jedoch stark in den Hintergrund. Abgestorbene, mazerierte Schwämme oder Teile von Schwämmen werden von Serpeln, bereniciformen Bryozoen, Foraminiferen und anderen Kieselschwämmen bewachsen.

Mega-scale cross-stratification in tide-influenced Egerian sands of the Austrian Molasse

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The Kiscellian-Egerian shallow-water facies of the Molasse sediments along the southern margin of the Bohemian Massif in Austria is represented by the lithologically homogeneous Linz Formation in Upper Austria and the Melk Formation in Lower Austria. These formations form a laterally continous, locally up to 100 m thick, bipartite, transgressive, siliciclastic sand-sheet, with a major internal regressive boundary surface. Until recently these sands were regarded to be largely free of (visible) sedimentary structures, exept (sub)horizonal bedding planes, enclosing beds of several meters of thickness.

Recent outcrop-studies now have revealed a broad variety of facies types comprising nearshore conglomerates and beach sands, lagoonal sands with crowded echinoid traces (and other trace fossils), generally medium-scale cross-stratified sandwave facies, and channel-fill facies.

Cross-bed measurements and structural features of the sandwave facies give evidence of a tidal current regime. Tide-influenced sediments of this time are known until now only from the